Design & Control of Exoskeletons for Rehabilitation

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Outline

The Exoskeleton

- Motivation

Design of an Exoskeleton

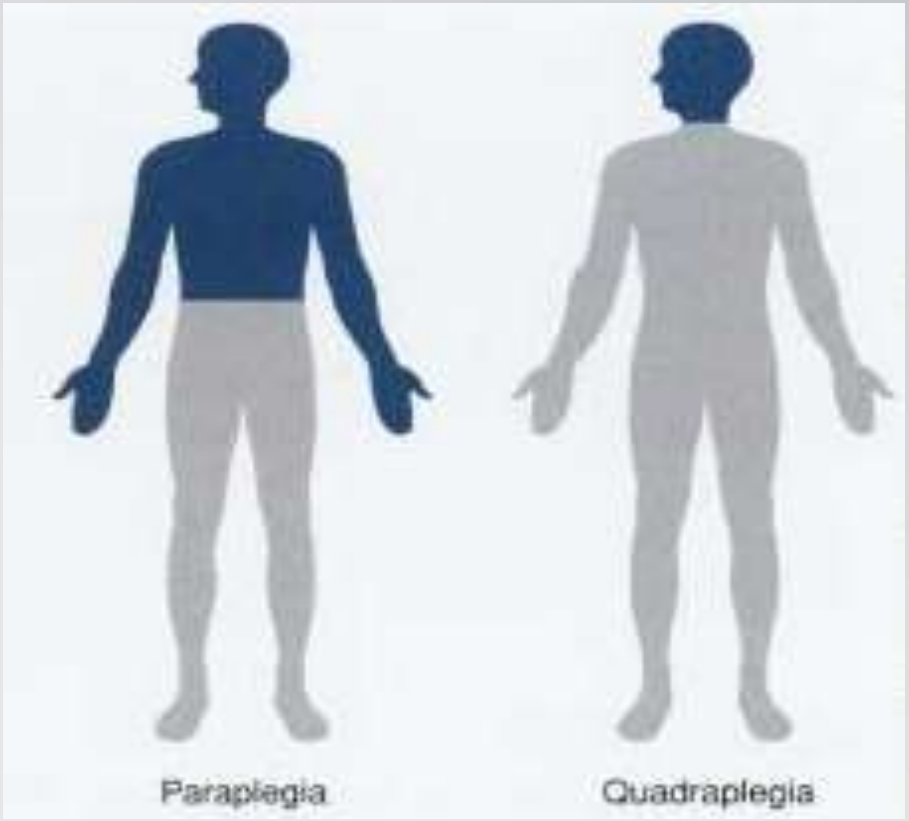
- Design requirements
- Design features

Controlling an Exoskeleton

Demo / Q&A

Spinal Cord Injury

- 250,000 Americans have spinal cord injuries[1]
- 52% are considered paraplegic, 47% quadriplegic
- Standing and being mobile has health and psychological benefits.



What other Diagnoses?

- Spinal cord injury
- Traumatic brain injury
- Stroke
- Multiple sclerosis
- Etc.

Why exoskeletons?

- Gait training
  - Repetitive stepping
  - Varied assistance
  - Balance training
- Long-term Use
  - Bone density?
  - Bowel & bladder function?
  - Pain?
  - Circulation?
  - emotional

Mobility Options

Mobility Options: Robotics

Indego
Parker.com

Rex
Rexbionics.com

ReWalk
Argomedtec.com

Ekso

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Design Requirements

- Brainstorm time!

Size Adjustment

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Fit Kit & Padding

Donning / Doffing

Safe Motion / Fail Safe

- Hard stops & soft stops
- Adjustable settings for SW Joint limits
- Normally-on brakes

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Step Initiation

- Physical Therapist Mode
  - Therapist initiates steps
  - Used for teaching and guiding user
  - Requires second person

Step Initiation

- Pro Step
  - Utilize the user's body position to determine when a step should be taken
  - Safety prioritized - no false triggers

Thank You